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ABSTRACT

A study focused on students' retention of experiences associated with an interpretive school field trip. Third- and fourth-grade students from a rural Midwestern elementary school took an interpretive field trip to a local park to learn about their local environment. A survey was administered to the 71 students 1 month and 18 months after the completion of the field trip. Learning about nature, games, and the hike were the three most-remembered categories for both survey administrations. Learning about nature was composed of general and nonspecific replies. While very few surveys contained specific references to what was learned about nature, many contained references to songs that were sung and games that were played. This supports the idea that activities that involve multiple sensations are more memorable. However, it was not determined that environmental information was gained from these activities. It was predicted that experiences that were rehearsed or interconnected with existing information might prove more memorable, but little support for this prediction was found. Results revealed that memories were nonspecific and dissociated from specific information given by the interpreter, but that students did gain a positive attitude toward returning to the park that continued over the long term. (Contains 36 references.) (TD)

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Introduction

There are literally thousands of outdoor interpretive centers located throughout the country. Over twenty million elementary and junior high students take field trips to these facilities each year (Ramey, Walberg & Walberg, 1994). A national survey administered to primary and secondary educators found that almost half of the teachers polled take their students on a non-formal outdoor field trip (World Wildlife Fund, 1994).

The outcomes desired by the interpreters leading these field trips tend to represent variables such as visitor knowledge, attitude, and behavior toward the resource site (Knapp, 1994). Orion and Hofstein (1994) report that during the last two decades there has been increasing interest in these non-formal experiences along with a sharp increase in empirical studies evaluating their impact. A significant proportion of this research has supported the notion that an interpretive experience can positively impact the knowledge of the resource site and its related subjects (Koran, Koran & Ellis, 1989; Lisowski & Disinger, 1988; Ramey, Walberg & Walberg, 1994).

The strong evidence that an interpretive experience can promote initial knowledge retention sets up a more difficult question: how long do these students hold on to this information? More precisely, what do the students remember one month or more after the initial treatment? Are these memories associated with interpreter-derived program objectives or tertiary variables such as social or environmental factors? Can the memories from this experience impact a student's attitude toward the resource site? These are questions that are looked at through this pilot study evaluating short term and long term retention of experiences associated with an interpretive school field trip.

The researchers note that the literature on the relationship of memory and an outdoor interpretive field trip is virtually nonexistent. Therefore, this paper will bring to light models on memorable experiences from the fields of psychology and education. A theory of long term memory developed by Tulving (1972) was used as a basic paradigm of correlation for the subsequent investigation. A pilot study was implemented to look at retention of information from an outdoor field trip one month and 18 months following its implementation. The memories that are recorded from this evaluation are hypothesized to be rooted in what Tulving would define as episodic memory.

Literature Review

Most research conducted on the interpretive field has not focused on memory. The bulk of the research available on interpretive programs has measured changes in environ-

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mental knowledge (e.g., Jordan, Hungerford, & Tomera, 1986; Lisowski & Disinger, 1991; Ramsey & Hungerford, 1989), changes in participants' attitudes (e.g., Jaus, 1984; Ryan, 1991), or changes in participant behavior (e.g., Asch & Shore, 1975; Jordan, Hungerford, & Tomera, 1986; Ramsey & Hungerford, 1989). Since research on field trip memory and retention is still in its infancy, memory theories and models from psychology and education were used to guide this project. In addition to field trip related memory literature, information processing, episodic and semantic memory distinctions, and long term retention literature was reviewed.

Memory Research Related to Field Trips

While memory research related to field trips is lacking, there have been several studies that are relevant. Mackenzie and White (1981) completed one such study that compared three groups of eighth and ninth grade students on a variety of dependent measures based on a retention model proposed by Gagne and White (1978). One group, serving as a control, did not participate in any field experience. A second group participated in a passive (observational) field trip, and the final group actively participated in the field trip. Results showed that those participants who were actively involved in the field trip demonstrated a better understanding of the course materials immediately following the field trip and showed significantly less loss of knowledge over a 12 week period than both the comparison (non-interactive field trip) and control (no field trip) groups (Mackenzie & White, 1981).

A study conducted by Jones, Eagles, Fallis, and Hodge (1994) looked at memo- In this model (see figure 1), information enters through a sensory register (sensory ries associated with half and full week field trips to the Boyne Natural Science Center. They collected survey data on what participants remembered one to four years after visiting the interpretive science center and nature preserve. The most remembered things were the ropes course, the food, hiking, friends, dorms, interpreters, caving, night hikes, black flies, and campfires.

In a similar study, Cline (1996) surveyed participants of a weeklong residential camp in Indiana. Her subjects, then seniors in high school, had attended a weeklong program at Bradford Woods Outdoor Education Center when they were in fifth grade. This was a traditional outdoor education experience that included program objectives of nature study, outdoor skills, and environmental education. Cline found that the most remembered things were a Lifesaver's sparkle party, cabin skits, hiking, and food. Few references were made to any educational objectives. Cline also noted that the informal discussion between subjects that took place after the survey was rich with information not documented on the survey instruments. Discussion topics following the questionnaire included memories of hiking the "killer hill", being scared to walk in the woods at night, and being nervous about being away from home. Additionally, she noted that all participants, even those that indicated they did not enjoy the weeklong residential camp, laughed and fondly reminisced with the others during the informal conversations following survey completion.

Introduction to the Information Processing Model

The information processing model proposed by Atkinson and Shiffrin (1968) provides a framework for memory research. memory); it is then either lost or moved to a short term store (working or short term

memory) for processing. The short term store information can either be discarded or passed along to the long term store (long term memory). Unlike the temporary memory stores in the sensory and short term stores, once information enters long term memory, it can only be lost through interference or decay (Atkinson & Shiffrin, 1968).

Subsequently, the concept of metacognition has been applied to this model and serves to oversee the flow of information between memory registers (Benjafield, 1997). Nonformal education research has begun to critically analyze one or more aspects of the information processing model. Studies in both long-term and sensory memory have been conducted to document the impact of school field trip experiences on memory (Falk & Dierking, 1997). In particular, data in nonformal arenas is pointing to the importance of long term memories. As Falk and Dierking state: "Evidence from a variety of investigations is emerging that shows that much of what an individual comes to discover about what he or she "learned" in a museum only becomes apparent weeks, months, or even years after the experience" (p. 212).

Sensory Memory

Information enters the information processing model through sensory memory which measures perception. An input from the senses is compared with knowledge from long term stores, and, if this perception is worth recognizing, the sensation may be passed on to working memory for processing. Otherwise the sensation is discarded (Atkinson & Shiffrin, 1968).

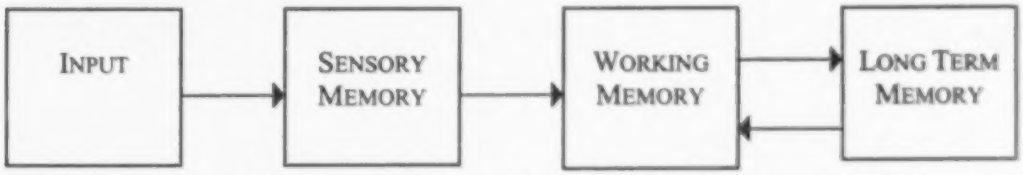

Figure 1. General information processing model based on a model proposed by Atkinson and Shiffrin (1968).

Many of the field trip teaching aids or guidebooks (e.g., Redleaf, 1996) emphasize the necessity of using as many senses as possible during field trips: looking, listening, smelling, touching, and tasting. This allows the information to enter the sensory memory through a number of paths.

Some research supports the idea that information that enters through multiple senses (dual-coded memories) is more easily remembered. Clark and Paivio (1991) found that information that was learned both verbally and non-verbally was better remembered than information coded from only one source.

Working Memory

Working or short term memory has a limited capacity. Miller (1956) found that working memory could usually hold seven plus or minus two chunks of information at one time. As new information enters from the sensory register, the information in working memory must either be rehearsed or moved to long term memory, or it is lost. The process of over learning by repeated rehearsal in working memory stores has

been found to greatly enhance recall (Farr, 1987). Additionally, processing information by thinking about its relevance and interconnections has been shown to enhance recall. Mackenzie and White (1981) found that fieldwork which encourages processing will produce greater linking of episodes with knowledge than field trips lacking processing. This processing and linking enhances knowledge transfer. Students must be actively involved in processing new information, forming connections, and drawing conclusions about their experiences.

Long Term Memory

Long term memory is the final component of the information processing model. While there are several models of long term memory, Tulving's (1972) proposed distinction between episodic and semantic memories provides the most appropriate framework for event specific memory research. According to Tulving (1972, 1983) propositional knowledge is broken down into episodic and semantic components. Episodic memory is "involved in the recording and subsequent retrieval of memories of personal happenings and doings," while semantic memory is "knowledge of the world that is independent of a person's identity and past" (Tulving, 1983, p. 9).

While episodic and semantic distinctions are practical for research and discussion, there is much debate as to whether two separate mental systems exist in the head. However, from an ecological viewpoint this is unimportant. "From an ecological point of view, the answer is straightforward, episodes and impersonal facts (for example) are separate classes of rememberable things. They are not mental categories but environmental ones" (Neisser, 1985, p. 274).

There are several key differences between episodic and semantic memories (Tulving, 1983): (a) episodic memories are located temporally while semantic memories are located conceptually; (b) episodic memories involve emotion while semantic memories are separate from emotion; (c) episodic memories have less general utility; (d) episodic memories are unrelated to intelligence; (e) episodic memories are less important to education; and (f) episodic memories are generally more readily forgotten.

There is support for transfer of knowledge from episodic to semantic memory in Tulving's model. After a stimulus sets a memory cue into motion, this cue searches pathways for relevant memory traces or engrams. As the memory trace is accessed by the cue, something happens that Tulving (1983) termed "synergistic ecphory." Ecphory is "the process by which retrieval information is brought into interaction with stored information" (p. 178). This ecphoric information determines the rememberer's recollective experience of the past episode, as well as its potential for convertibility into other forms of knowledge. Memories are retrieved by associations that are formed both at the time of the memory and are subsequently constructed and destroyed as the mind creates different associations which enable it to recall memories based on sensory cues (Tulving, 1983). So, memories that were originally coded as episodic memories, tied to a specific event in time, may be recalled, reprocessed, and recoded as semantic memories through ecphory.

Some proponents of ecological memory research believe that "all generalized knowledge is rooted in episodic experience. (However) meanings and general knowledge become disassociated from the context in which they were acquired" (Bahrick & Karis, 1982, p. 429). If informa-

tion does become disassociated from the original context in which it was learned, tracing knowledge learned on a field trip back to the specific moment of learning might prove difficult.

Long Term Retention. There is ongoing debate in the literature as to whether long term memory stores (episodic or semantic) are permanent or decay over time. The two competing theories are interference theory and decay theory. Interference theory basically states that memory traces or engrams are not lost, but rather access becomes confused as similar memories form. For example, the path that once led to engram A now leads to engram B, and engram A becomes inaccessible. Decay theory posits that memory traces or engrams weaken and disappear over time if not used. For a further discussion on decay and interference theories see Goldmeier (1982) or Tulving (1983).

Several factors have been found to enhance long term recall. Rubin and Kozin (1984) found that personally significant, emotionally involved, consequential, surprising, recent, and rehearsed memories were the most easily and vividly (in terms of level of detail) recalled. Thompson (1982) found that unique events were more easily placed in time than rehearsal enhanced memory. Bahrick (1984) found what he termed permastore for some memories taught in a Spanish class and found that most of the forgetting that did occur happened in the first three to six years after learning ceased. It appeared that concepts not lost after six years were permanently stored in memory.

The memory related literature revealed several possible outcomes for field trip research: (a) experiences that involved multiple senses might prove more memorable; (b) experiences that were rehearsed or interconnected with existing information might prove more memorable; (c) emotionally involved and personally significant events might be more easily recalled; and (d) much of the information gained during the field trip might have become disassociated from the learning context.

Method

Subjects were 71 third and fourth graders from a rural, Midwestern elementary school. These third and fourth graders took an interpretive school field trip to a local park to learn about their local environment. The field trip interpreters followed a script that was divided into seven sections: (a) during the introductory section, the interpreters set standards and goals for the day, ran a game or activity, and set up a plant transpiration experiment; (b) the discovery section allowed students to collect plants, ask questions, and to discuss issues raised; (c) during the discussion section, an adaptation activity was conducted and students were guided through discussions on adaptation, the importance of plants, and plant facts; (d) the guided adaptation walk allowed students to discover plant adaptations, to locate manmade items, and to discuss adaptations and their functions; (e) after the walk the transpiration experiment was discussed; (f) the interpreter then asked a series of review questions; and (g) the students participated in a concluding game or activity.

The survey instrument (see Appendix) consisted of four open-ended questions and was completed by most respondents in less than 15 minutes. The instrument used a cued recall and a funneled approach so that the earlier questions would not prompt memories relevant to subsequent questions (Bahrick & Karis, 1982; Jobe, Smith, & Tourangeau, 1993). The survey was admin-

istered one month (P1) and 18 months (P2) after the completion of the field trip. At P1, 100% of the participants filled out the surveys. At P2, the response rate was just over 35%.

After the data at P1 was collected, two researchers coded the data into categories for content analysis. The two sets of independently generated categories agreed highly and additional discussions created a set of agreed upon groupings. These same groupings were used in the subsequent analysis of the data collected at P2. The high level of agreement between researchers working independently supports the validity of the emergent categories generated (Miles & Huberman, 1994).

Results

Results from the first two open-ended questions were combined during analysis. No consistent differences were found between the student's "most memorable" experience and "three activities that they did" while on the field trip. The combined results from questions 1 and 2 can be seen in Figure 2. Over 50% of the respondents at both P1 and P2, respectively, remembered learning about nature (54%, 68%), playing tag or games (72%, 56%), and going on a hike (62%, 60%). The scavenger hunt, which was mentioned by 59% of the respondents at P1, was only mentioned by 20% at P2. The only other consistent categories included eating (6%, 12%), singing (15%, 12%), and taping one's thumbs together as part of an adaptation exercise (6%, 16%).

Question 3 asked if the subjects remembered a specific activity that the interpreter used to help them learn how a tree transpires. At P1, 37% remembered, while only 20% still recalled the activity at P2.

Question 4 asked if the subjects would like to return to the same park to learn more about plants, would like to go to another park to learn about plants, or if they would rather not go to any park to learn about plants. At P1, 79% indicated a desire to return to the same park, 7% indicated a desire to go to a different park, and 14% indicated a desire to go to no park to learn more about plants. At P2 the responses were similar; 79% indicated a desire to return to the same park, 13% indicated a desire to go to a different park, and 7% indicated a desire to go to no park to learn more about plants.

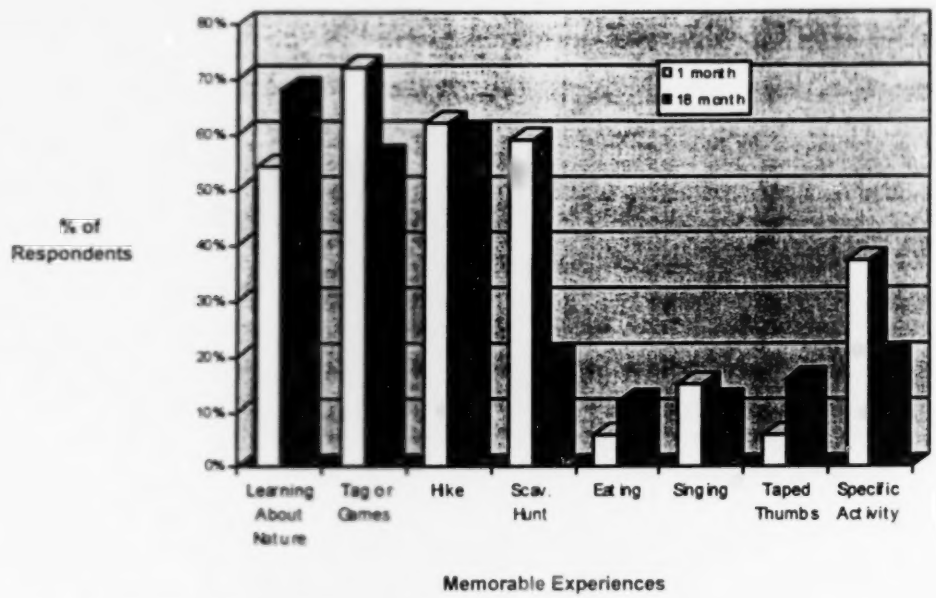

Figure 2. Summary of survey results.

Discussion

One of the limitations of this study is the response rate for the subsequent testing at 18 months after the field trip. In an effort to comply with the Human Subjects Board, each student was required to have a second informed consent signed by a parent and returned to their teachers (the initial informed consent was only for the survey administered at the 1-month interval). Many of the students felt that they remembered very little about the field trip and did not desire to participate in the second survey. Despite this low response rate, the data from P1 and P2 were generally in agreement, which would tend to indicate that the second sample was representative of the population.

Learning about nature, tag and games, and the hike were the three most remembered categories. Learning about nature was composed of general and non-specific replies. Representative comments included: "learning about plants," "learning about leaves," "learning about nature," and "learning about evergreen and deciduous trees." These responses could indicate that specific learned information has become disassociated from the field trip, or they could indicate that further probing was necessary to elicit a more detailed response. It is possible that students, knowing the general goal of a field trip to a nature center, recalled learning about nature as an obviously correct response.

While very few of the surveys contained specific references to what was learned about nature, many contained references to songs sung and games that were played. Responses included, "the treasure hunt we did" or "doing the taped thumb game". This supports the idea that activities that involve multiple sensations are more memorable. It is likely that these games and songs were both novel and emotionally charged, which would make them more memorable. However, additional probing would be necessary to determine if envi-

ronmental information was gained from these activities. Additionally, it was predicted that experiences that were rehearsed or interconnected with existing information might prove more memorable. While it is likely that this is the case, little support for this prediction was found.

Many of these responses suggest that this type of event-specific memory yields an incomplete representation of how a field trip is connected to memories and learning. If, as Tulving (1972) proposes, episodic memories can be transferred to semantic information, then when does the learning take place? If a teacher guides a student to remember a field trip transpiration activity during class, and this classroom instruction combined with the field trip forms a new understanding of transpiration, where did the learning take place? To add to the complication, if this new level of understanding becomes disassociated from the time and place of learning, then finding this connection between field trips and learning may be difficult.

Conclusion

Memories can be constructed, retrieved or destroyed. Episodic memories, associated with specific events, may be recalled and recoded as semantic memories. The latter tends to be associated with conceptual, independent knowledge. On the other hand, if information is not worth recognizing, the memory of that data may be discarded. Since knowledge retention has been found to be successful with interpretive programs, it is important to postulate: what does happen with knowledge immediately and subsequently following an interpretive experience? Are memories of the information and experiences related to the field trip episodic or does some of the information become retrieved as semantic memory?

This paper offered basic paradigms to begin the study of memories that were gained or lost through an interpretive field trip. Attempting to learn what if any of the experiences of this short event impacted semantic memory would be difficult. But this study is a first step towards discovering episodic memories that were gained from an outdoor interpretive program.

The one month and 18 month post-tests administered during this study revealed that memories were non-specific and disassociated from specific information given by the interpreter. In fact, most of the participants during both tests could not recall the specific activity that was used to associate transpiration – a concept reviewed during the field trip. However, results from both tests yielded positive response to returning to the outdoor site. This would infer that while not retaining specific objective-oriented content, students did gain a positive reaction to returning to the park that continued over the long term.

The researchers recommend further qualitative and quantitative studies to attempt to track specific information given during an interpretive experience. Do the memories of this information "decay" resulting in only memories of the experiences associated with the content implementation? Can specific resource site information gained from a field trip become associated with long term semantic memory? Are attitudes towards the resource site subject to change over time or do they continue to be strong as noted in this study?

Millions of students participate in outdoor interpretive field trips. Research has shown that they do gain knowledge about the resource site they are visiting as well as related concepts. Further research is warranted to learn what they remember about

these experiences, for how long and to what degree it enters into long term knowledge retention.

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